The Present Status of Female Sterilization Techniques in the United States

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THIS study was undertaken to discern the methods of sterilization used by leading gynecologists and obstetricians in their own practices. Although there are many carefully prepared and critically analyzed reviews of tubal sterilization techniques presented at regular intervals in the literature, each of these studies is presented to extol the virtues of one technique. To crystalize the opinions from the various sections of the United States, we have sent a questionnaire to the members of the teaching staffs of the medical centers and in this paper we have summarized the returned answers.

Historically, sterilization of the female has been of interest to the medical profession since first contemplated by Hippocrates as a means of eliminating hereditary perpetuation of the insane. It is difficult to trace accurately the earliest attempts at sterilization because we have reports of cesarean sections in Sanskrit translations on ancient Hindu medicine from the fifth century. There are Biblical references to cesarean operations in Jewish history from the second cenutry.[4] It is not illogical to assume some attempts at sterilization were made in the early centuries.

In the early part of the Nineteenth Century, G. P. Michealis suggested hysterectomy with cesarean section for sterilization, and in 1834 von Blundell removed the uteri from four rabbits. Of the four rabbits hysterectomized, three lived, giving reassurance to those who were to attempt gynecological surgery in the years following. His technique included bringing the stump of the cervix to the abdominal wall, a forerunner of Porro's operation, introduced in 1877. Von Blundell is also credited with the initial written suggestion of tubal sterilization in his textbook, published in 1834. The method he suggested was tubal resection, but he wrote that simple division might successfully prevent pregnancy.

Froriep, in 1850, suggested the creation of a chemical slough stricture in the upper uterine angles to prevent pregnancy. This was the forerunner of the recent suggestions for sterilization by intrauterine cauterization. During this era, the uterus was thought to have definite endocrinal function, so hysterectomy was rarely done for primary sterilization. In 1880, Lungren of Toledo, Ohio, tied both tubes after a second cesarean operation; this is the first recorded truly tubal sterilization. It is of interest to observe that that his follow-up notes elaborated upon the regular monthly menstruation after the operation, indicating the paucity of knowledge about the physiology of menstruation at that time.

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Between 1880 and 1910, a wide variety of procedures were carried out with uniformly poor results. A report by Leonard[8] in 1913 emphasized the high incidence of failure in all methods of sterilization, including cornual resection, intra-uterine cauterization, and total salpingectomy. Nurnberger's report in 1919 described 36 methods of tubal sterilization and concluded that salpingectomy or cornual resection was the best. The large number of procedures in his report emphasizes the keen interest in perfecting a reliable technique.

Madlener's publication in 1919 received widespread acclamation in this country and in Germany. The certainty of the results, however, were questioned as early as 1921 by J. Whitridge Williams,[13] although in 1926 and again in 1932 Madlener published two series without known failure.

Many new techniques were developed from 1920 to 1940. Unusual among the procedures suggested for sterilization was intra-uterine actual cautery to the tubal openings, propounded as a "simple office procedure,"[1] and the creation of a double vagina, one to be a blind pouch for coitus, and the other for pregnancy.[5]

Von Groff[10] reviewed 4,279 cases of sterilization by the Madlener technique, wherein he made critical analysis of the failures. He attributed them to slipping of the ligature, laceration of the serosa which encouraged fistula formation, and tying of the round ligaments by error. He concluded that the failures resulted from not adhering to Madlener's exact technique.

Dippel[2] in 1940 studied postoperative tubal specimens with serial microscopic sections from five patients who became pregnant after sterilization by Madlener's method. He reemphasized von Groff's findings on the technical failures, and demonstrated two cases of endosalpingiosis, a process which Sampson publicized in 1921.

Lazard,[7] in 1940, reviewed the entire subject and concluded that subtotal hysterectomy was the most satisfactory procedure.

In 1933 and again in 1939, Lull[9] reported extensively upon the method of tubal sterilization introduced by Pomeroy, stating that in his clinic the method had given exceptionally fine results. His careful analysis of the reported failures of the Pomeroy method bears out the importance of exactly adhering to the technique. His papers offer proof that Pomeroy's technique is the simplest and safest of the tubal type sterilizations.

In 1946, Knight[6] compared the results of the Pomeroy operation with the published statistics on the Madlener method. He concluded that the 0.31

per cent failure in the Pomeroy operation was better than the 0.6 per cent average of failures in a large series of the Madlener type.

Any discussion of sterilization procedures cannot circumvent the problem of endocrinal failure attendant to the operation for sterilization, and for that reason a brief review of the literature is presented. Lungren's contribution that tubal ligation did not interfere with menstruation has been mentioned. Dippel,[3] in 1939, demonstrated that only 16.6 per cent of patients had menopausal symptoms following hysterectomy, when sterilization was the primary indication for surgical operation, but that more than 67 per cent of the patients who had a hysterectomy for definite pelvic disease complained later of menopausal symptoms. He concluded that involvement of the ovaries in the disease, rather than the hysterectomy itself, was the principal cause of endocrine failure.

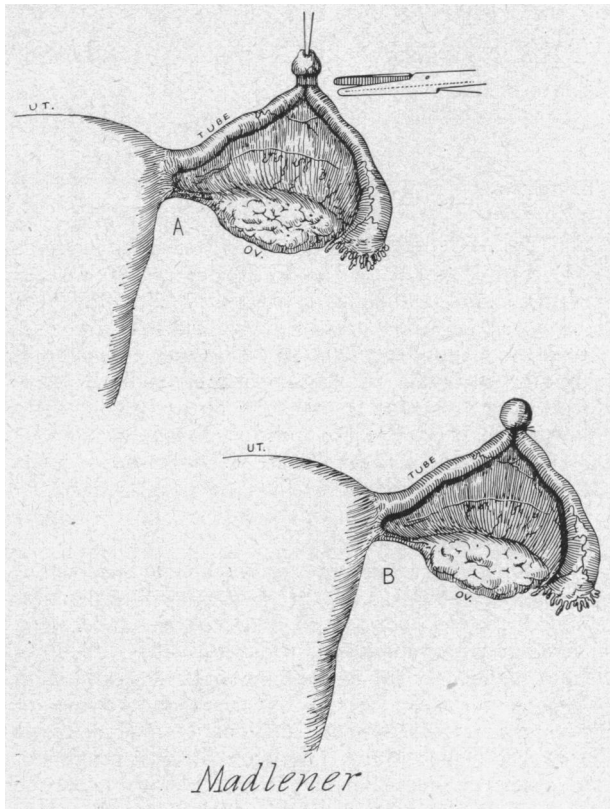
Vruwink[11] and Papenoe undertook an exhaustive study of libido following sterilization in 1930 and concluded that one woman in four does not enjoy coitus after sterilization, but that this fact is not mentioned to the surgeon, usually because he does not ask about it. They also concluded that bilateral salpingectomy did not affect libido; in fact, one third of the patients reported improved sex life when pregnancy was no longer feared. Hysterectomy, plus salpingectomy, had no demonstrable effect on libido, according to their records. It is of interest to discover in their conclusions that bilateral oophorectomy may leave the well adjusted woman with no change in her satisfactory sex life, but that the young, unadjusted and near menopausal woman is usually quite dramatically affected; her libido is markedly decreased. Watson[12] concluded that the removal of the uterus does not tend toward earlier menopause.

After careful perusal of the available history of sterilization which has been presented here in condensed form, it is concluded that the following five methods of tubal sterilization have apparently survived the test of time and are in common use. These were the basis for our questionnaire and the methods seem to serve most obstetricians and gynecologists in the United States. Many indicated that they used variations of several of these methods and only one or two used a new technique.

1. Madlener sterilization which consists of bringing up the fallopian tube through a small abdominal, or posterior coloptomy incision, crushing its middle third and tying the loop with non-absorbable suture. (See illustration).

2. The Pomeroy technique (see illustration) which resembles the Madlener operation, in that it can be done through the small abdominal or posterior coloptomy incision. The tube is grasped in its mobile middle third and pulled up to a loop, which is tied with fine absorbable catgut. There is no preliminary crushing of the tube. The loop lying above the tie is then excised and after a very careful check for bleeding, the tube is dropped back.

3. The cornual resection (illustrated) which consists of the excising of the cornual portion of the tube in a wedge shape. The margins of the incision are carefully closed and the bleeding arrested. The remaining cut end of the tube is buried into the broad ligament and the raw areas covered with the round ligament.



4. The method devised by F. C. Irving. He divided the tube in its middle third and buried the cut end of the proximal portion into the myometrium of the posterior corpus. (See illustration).

5. The Watson method of tubal sterilization which consists of excising the middle portion of the tube and burying the proximal cut end into the broad ligament, as shown in accompanying illustration. The distal cut end lies free in the abdomen.

Upon the background of the historical and literary review of the sterilization problem, we present the results of the questionnaire sent to leading members of the American Board of Obstetrics and Gynecology in each section of the country. A distinct effort was made to send queries to men closely affiliated with medical teaching centers. Table 1 is a replica of the questionnaire answered by 124 of these men.

We received replies from more than 70 per cent of the doctors. Many of the remaining questionnaires were returned unanswered because of war displacement.

The returned questionnaires have been analyzed in several ways in an attempt to show: (1) Which procedure for sterilization is the most universally used by obstetricians and gynecologists. (2) What change in procedure is made when sterilization follows cesarean section or is a part of laparotomy; (3)

TABLE 1.—*The Questionnaire Which Supplied the Data for This Study.*

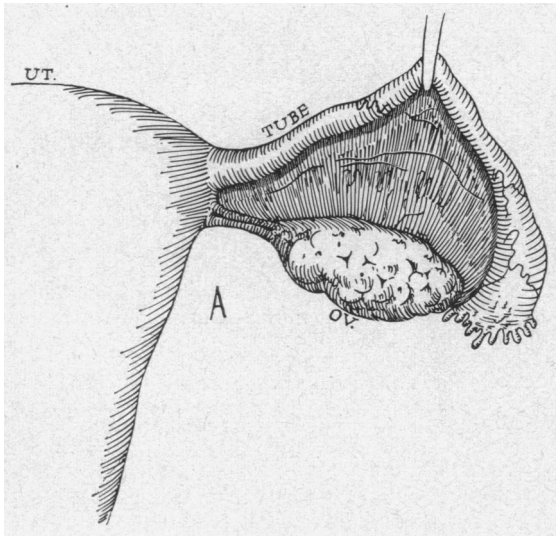
Which of the following methods do you employ as a usual routine in sterilization?

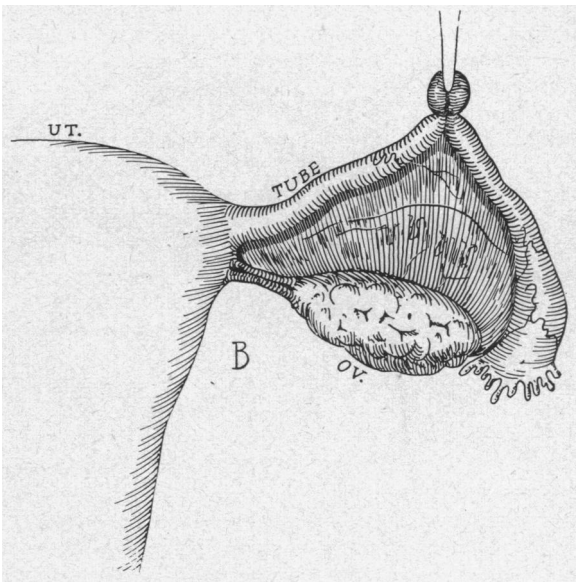
	Following Cesarean	With Laparotomy
a. Pomeroy		
b. Madlener		
c. Cornual resection		
d. Watson		
e. Subtotal hysterectomy		
f. Other		

What percentage of cases do you *estimate* show menopause symptoms one to three years after hysterectomy when that operation has been performed on women under 30 years of age?.....%.

Regional influence from adjacent medical centers upon procedures chosen; (4) The impressions of obstetricians and gynecologists concerning the onset of menopausal symptoms following hysterectomy in women under 30 years of age.

It was difficult to decide what definition could logically be applied to the regions selected. The influence of medical schools and prominent authorities in geographically adjacent areas intermingled and divided opinions most profoundly, especially in the areas between New York and Washington, D. C., and in the Chicago area. However, the areas selected as units comprise the results from cities as listed; the inequalities and ambiguities of our regional divisions are recognized but the results do bear contemplation. Table 2 lists the cities included in each area.





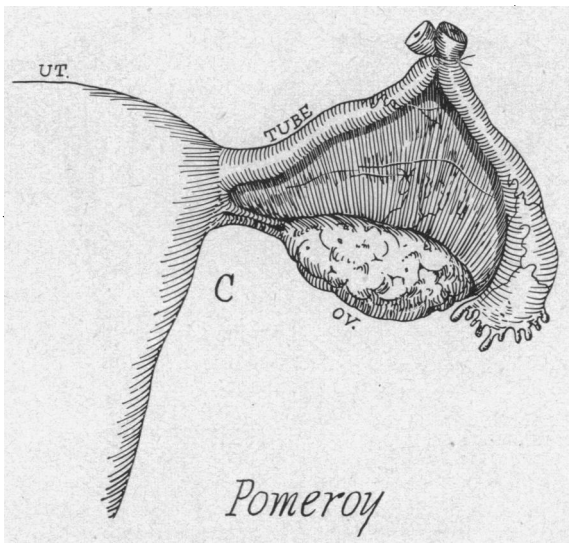
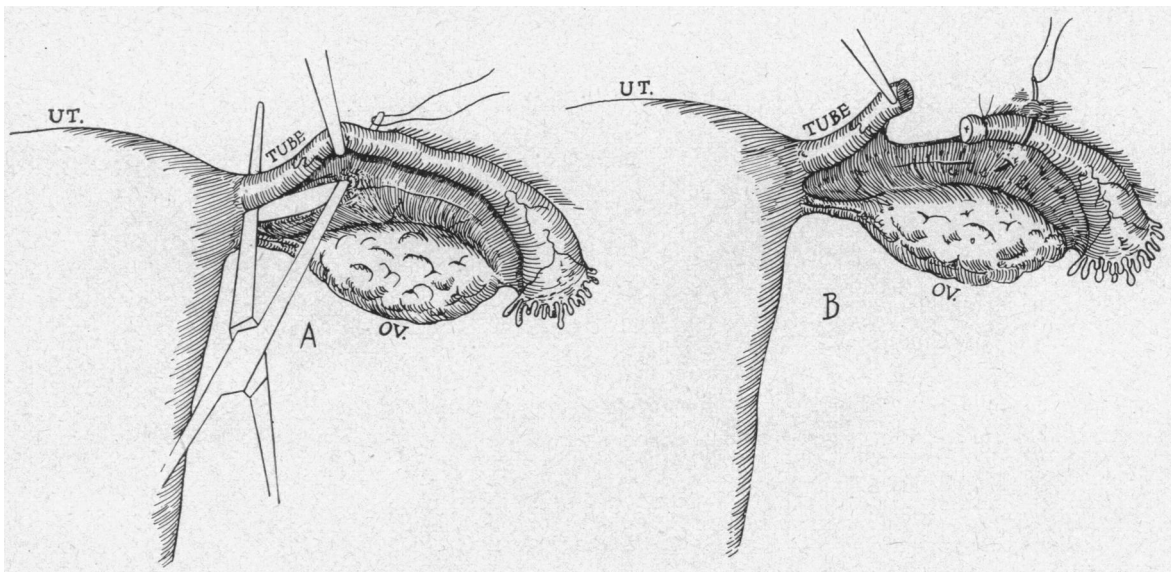
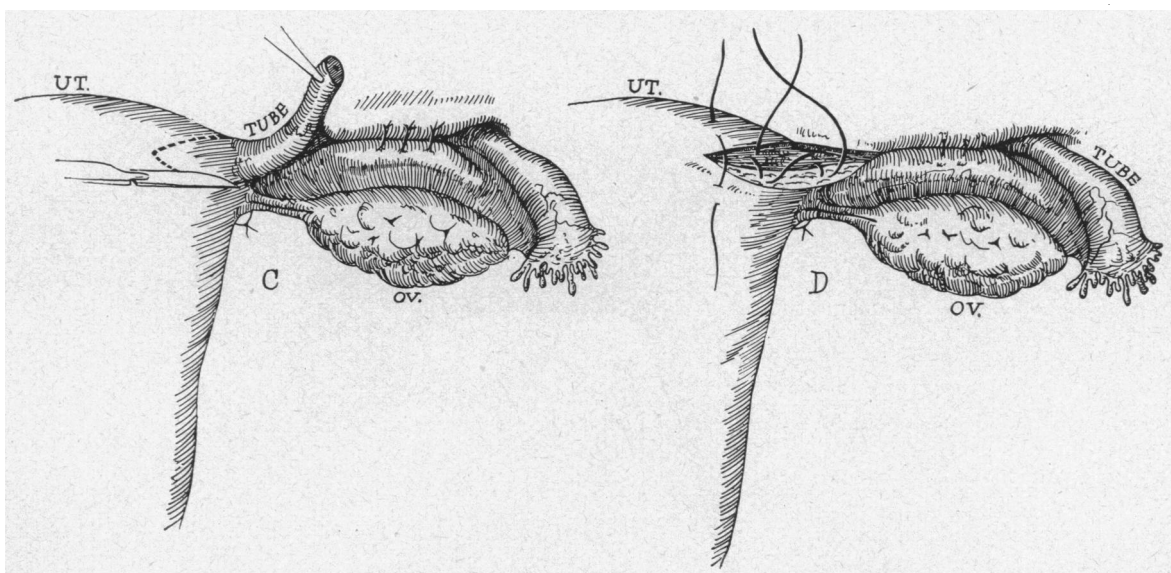


TABLE 2.—*Cities in the Various Areas to Which Questionnaires Were Sent*

LOS ANGELES AREA:	SOUTH:	CHICAGO AREA:	NORTHWEST AREA:
Santa Monica	Huntington, W. Va.	Indianapolis	Portland
Beverly Hills	Birmingham, Ala.	Rochester, Minn.	Vancouver
Glendale	Washington, D. C.	Milwaukee, Wis.	Seattle
Pasadena	New Orleans	Detroit	NEW ENGLAND AREA:
Los Angeles	Morehead, N. C.	Cleveland	Providence
San Diego	Charlottsville, Va.	Chicago	Manchester, Conn.
NEW YORK AREA:	Durham, N. C.	St. Louis	New Haven, Conn.
Syracuse	Nashville, Tenn.	Columbus	Boston
New York	Charlotte, N. C.	SAN FRANCISCO AREA:	MIDWEST AREA:
Englewood, N. J.	Louisville, Ky.	San Francisco	Omaha
Brooklyn	Spartansburg, S. C.	Sacramento	Oklahoma City
Jersey City	Atlanta, Ga.	Berkeley	Kansas City
Atlantic City	Augusta, Ga.	PHILADELPHIA AREA:	Iowa City
Rochester, N. Y.	Little Rock	Philadelphia	Denver
Baltimore	Miami, Fla.	Pittsburgh	San Antonio





Cornual

The sectional influence can be graphically emphasized. Table 3 shows the sterilization procedures chosen with cesarean section. Herein is indicated the distinct preference for the Pomeroy technique in the area surrounding New York, Philadelphia, and in the South. In and about Chicago there is a slight favoritism for Madlener's method. However, the Los Angeles regional survey demonstrates an inclination toward subtotal hysterectomy not reported from other parts of the United States. Preferences from other areas varied, but it is apparent that most of the physicians who answered use either Pomeroy, Madlener, or cornual resection techniques routinely.

TABLE 3.—*Method of Sterilization Used in Various Areas in This Country*
(Cesarean)

Area	Pomeroy	Madlener	Irving	Cornual	Watson	Hysterectomy Subtotal	Hysterectomy Total
Los Angeles	4	1	0	2	1	4	0
New York	17	4	0	1	1	0	0
Chicago	7	10	1	8	2	1	0
San Francisco	2	2	0	2	1	0	0
Philadelphia	7	3	0	0	0	0	0
South	11	2	1	6	0	0	0
Northwest	1	0	0	3	1	0	0
New England	2	1	2	0	0	1	0
Midwest	5	4	0	1	0	0	0
Total	56	27	4	23	6	6	0

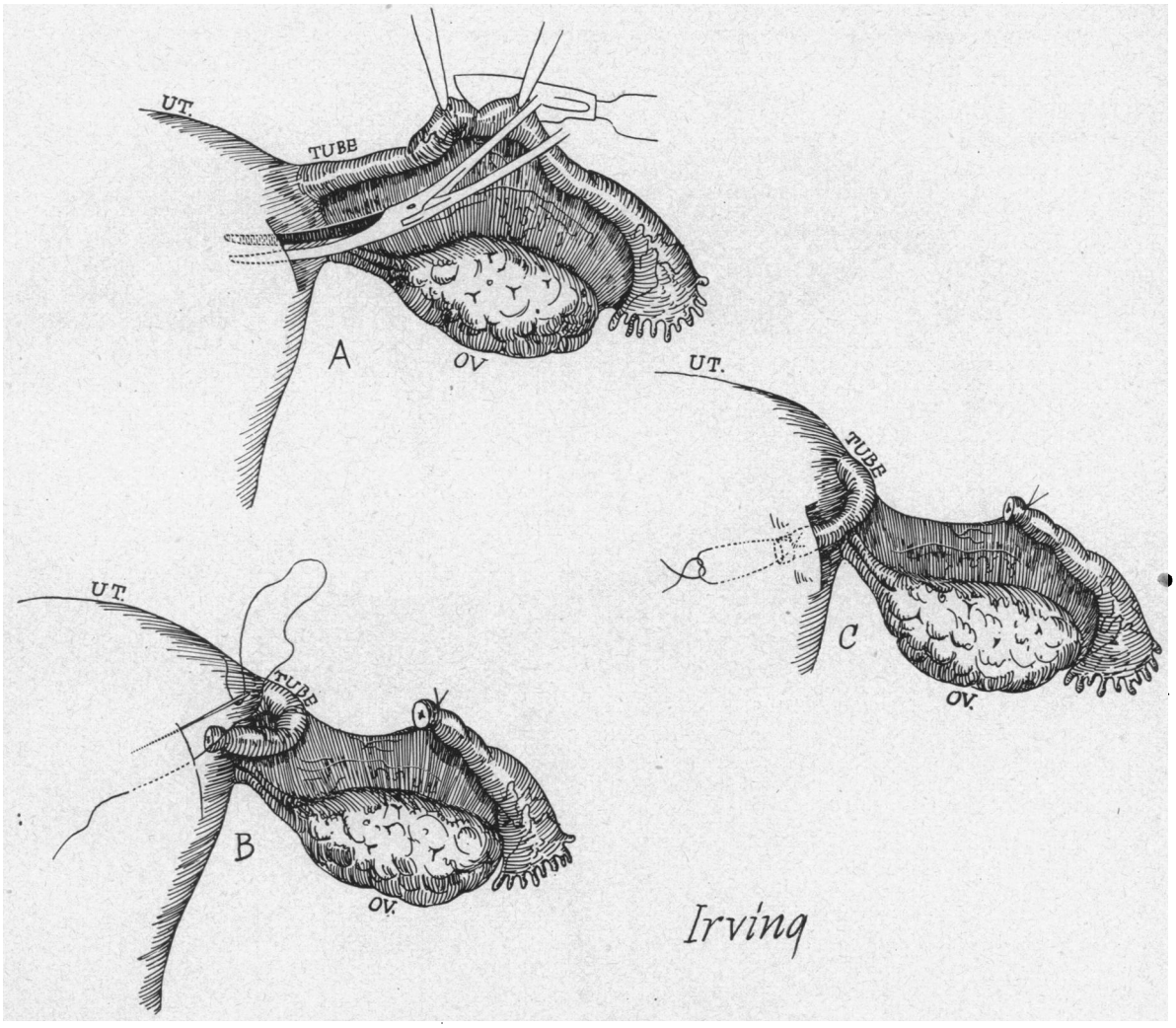
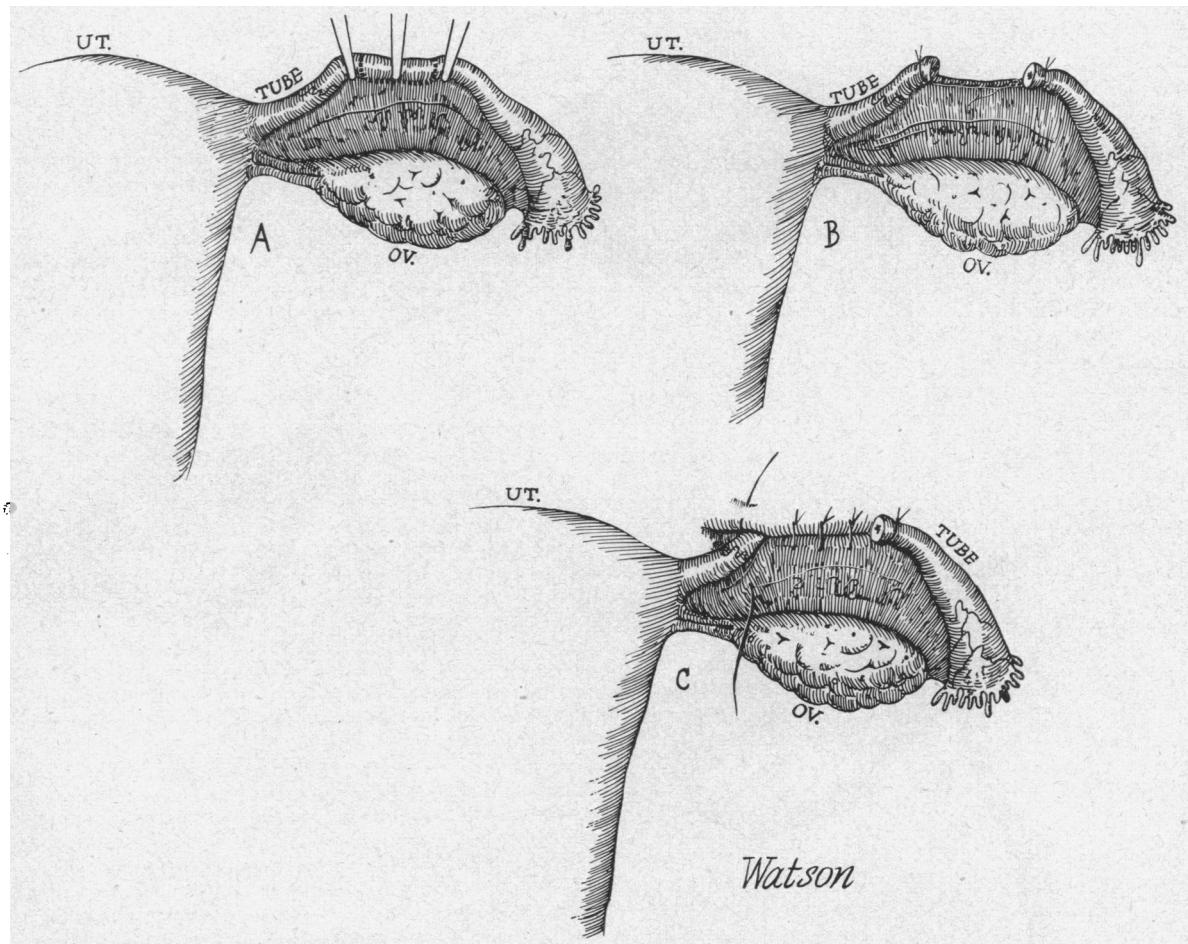


Table 4 shows the methods of sterilization used when laparotomy is done. In most instances these sterilization procedures were stated to be postpartum sterilizations. Many replies distinctly differentiated a change in technique to hysterectomy in cases in which there was a history of functional bleeding or any disease in the uterus or adnexa. Keeping in mind sterilization as the primary indication for operation, we can present the following observations. The New York area again prefers the Pomeroy method as a routine, but with increasing preference for cornual resection. The Chicago region indicated a shift toward cornual resection as the procedure of choice. There is no change of consequence in the figures from the South, except that two who answered from that area prefer total hysterectomy exclusively; this choice is also indicated in one reply from New England. Other sections of the country appear to be about equally divided in the choice of Pomeroy, Madlener and cornual resection with the exception of the Los Angeles area where subtotal hysterectomy again takes a prominent lead.

TABLE 4.—*Methods of Sterilization Used in Various Areas of This Country*
(Laparotomy)

Area	Pomeroy	Madlener	Irving	Cornual	Watson	Hysterectomy Subtotal	Hysterectomy Total	Salpingectomy
Los Angeles	2	0	0	2	1	6	0	0
New York	13	3	0	6	1	0	0	0
Chicago	6	7	1	10	2	1	0	0
San Francisco	0	2	0	2	1	0	0	0
Philadelphia	5	3	0	0	0	0	0	0
South	10	1	1	7	0	0	2	0
Northwest	0	0	0	3	1	0	0	0
New England	0	0	2	2	1	0	1	1
Midwest	3	4	0	2	0	0	0	0
Total	39	20	4	34	7	7	3	1



Again we repeat, many answers included comments to the effect that a hysterectomy, total or subtotal, was done if there was uterine disease; the choice of operation depended upon the indications dictated by existing conditions. These figures presented do not include hysterectomies as a sterilization procedure, unless the reply to the questionnaire indicated that sterilization was the primary reason for removing the uterus.

Many of the doctors included comments with the questionnaire. Among the most frequent of these was that cornual resection had been the procedure of choice until recently, usually about 1941, but that Pomeroy's technique is now replacing it because there is less bleeding and it is simpler and quicker.

In summary then, on this phase of our presentation, from 124 replies we found the results shown in Table 5. The Pomeroy technique is the most frequently used following both cesarean and laparotomy. Madlener's method is next most frequently used with cesarean, but the cornual resection is used more often with laparotomy.

TABLE 5.—*Methods of Sterilization in the Order of Frequency of Use with Cesarean Section and Laparotomy.*

	Cesarean	Laparotomy
Pomeroy	56	39
Madlener	27	20
Cornual	23	34
Watson	6	7
Subtotal Hysterectomy	6	7
Total Hysterectomy	0	
Irving	4	4
Salpingectomy	0	1

The answers to the question on the incidence of menopause symptoms within three to five years following hysterectomy in women under 30 years of age were interesting because of the diversity of opinion. Ninety-seven of the physicians returned a reply to this question, but 14 either (a) had not heard of the problem; (b) had insufficient experience to warrant an opinion; or (c) did not do hysterectomies on women under 30 years of age.

Experience among the remainder of the doctors ranged from 0 per cent to 98 per cent. It is quite apparent from Table 6 that the majority felt that there were no menopausal symptoms from the hysterectomy per se. However, five physicians thought that 95 per cent developed symptoms. To analyse a little further, 18 of the answers indicated such symptoms were present in more than 50 per cent of the patients, but 32 felt that they were present in none, and 44 replied that they were present in 1 per cent or less. One physician stated that menopausal symptoms followed cesarean section hysterectomy in only 15 per cent of the total number of cases, but that 40 per cent of the non-pregnant women developed the symptoms following hysterectomy.

TABLE 6.—*Percentage of Patients Under 30 Years of Age Showing Menopausal Symptoms After Hysterectomy.*

Answers to Questionnaire		
No opinion	14	
0	32	44
1	12	
5%	5	
10%	6	
15%	4	
20%	5	
25%	1	
50%	6	
75%	4	18
90%	3	
95% and over	5	

Many parenthetically injected comments brought out the thought that hysterectomy is seldom done in the absence of disease. The disease which involved the tubes and ovaries caused the development of the menopausal symptoms rather than did the hysterectomy itself.

In conclusion, we recapitulate the results of our questionnaire to show:

1. The Pomeroy method of tubal sterilization is the most frequently used following cesarean section and with laparotomy.

2. The Madlener technique is the second most popular method used after cesarean.

3. Cornual resection is the second most popular method with laparotomy.

4. Hysterectomy is chosen when uterine disease exists.

5. A majority of the physicians who answered our questionnaire believe that less than 1 per cent of the women under 30 who have had a hysterectomy suffered menopausal symptoms within three to five years.

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The authors are indebted to 124 physicians who showed the interest and courtesy to answer our questionnaire. The interest of Dr. Clifford Lull, who replied at length and sent reprints of his work is especially appreciated, and we are grateful also to the many who wrote their personal comments to help us evaluate their opinions.

Discussion by DONALD G. TOLLEFSON, M.D., *Los Angeles*

I am particularly interested in discussing sterilization from the medico-legal standpoint, for it must be constantly emphasized that the proper consent must be obtained from both the patient and her husband. This authorization blank should state that both the parties understand that the operation *may* render the individual sterile. This must be signed in the presence of a witness and the patient must not have had sedation within a reasonable length of time before the signing which might render her incapable of making the decision. It is also advisable to explain to the patient and her husband that the procedure cannot be undone once it has been performed. In the event that a laparotomy for pelvic disease may render the patient sterile, the couple should be informed of this possibility.

Sterilization without indication carries a real hazard to the physician from a legal standpoint, for, according to law, only the mentally ill patients committed to an institution may be so treated. While the consent of both husband and wife to an operation they have been told might make the wife sterile might seem sufficient (and no cases in this state have been tried), it is almost certain that sooner or later a physician may be called upon to explain why the operation was done.

It would, therefore, seem advisable that consultation with another physician be had whenever this procedure is considered.

It also should be brought out that the surgeon who performs the operation is responsible for his act and therefore ought not be just a technician. He must be able to justify his action with full knowledge of the facts, and not depend upon a referring physician to bear the responsibility. This is true for sterilization in either male or female.

Elective sterilization should not be treated too lightly, and some indication with a consultation of other physicians should be the rule.

This paper is interesting from several standpoints. It covers the history of sterilization techniques. It also reveals the wide variation in methods used in different medical centers of the country. The method chosen is apparently popular because of the stimulation of local outstanding physicians rather than its relative value over other types of procedure. Another point of interest is the evident marked difference of opinion among leading gynecologists as to what constitutes menopausal symptoms.

I should like to discuss the practical application of a few of the methods of sterilization mentioned. In 1938 I became acquainted with Robert Kimbrough in Philadelphia. He was using the Lull-Pomeroy technique at that time and had had a series of two hundred cases without a failure. I was struck with the simplicity of the procedure in comparison with cornual resection, especially at the time of cesarean section. To stop the venous bleeding from the broad ligments in doing cornual resection not infrequently took longer than the cesarean section. Since that time I have used the Lull-Pomeroy technique exclusively. It is not only an excellent means of sterilization with cesarean but it is also well adapted to the vaginal approach and the small, early post-partum, abdominal incision.

I am not an advocate of sterilization by hysterectomy in young women. An occasional failure or the rare development of a case of functional bleeding, following partial tubal resection is still on the whole preferable to the psychogenic or actual menopausal symptoms following subtotal hysterectomy. The wide variation in the percentage of menopausal symptoms following hysterectomy reported in the paper only indicates the difficulty in evaluating the importance and severity of such symptoms. I firmly believe that the patient should be given the benefit of the doubt and the menstrual function maintained whenever possible in women under the age of 36.

In cases where hysterectomy and sterilization are medically and legally indicated there is a place for fundectomy. The wedge-shaped excision of the fundus including the interstitial portion of each tube, allows the removal of the uterine contents and tubal interruption through one incision in the uterus. The soft tissue allows good peritonization.

In women approaching 40, I believe subtotal hysterectomy following cesarean section is the method of choice for sterilization purposes. Morbidity is less than with cesarean section and tubal ligation, the convalescence is shorter and the result more positive.

I have reviewed 27 cesarean hysterectomies performed during the past three years. The follow-up records reveal very satisfactory results on the whole. Nine of the patients menstruate for one day. All but one of these nine have stated that they wish I had stopped the process entirely. The other 17 have no different symptoms than the ones who menstruate.

In conclusion, I believe that the reported results of the Lull-Pomeroy technique of sterilization warrant its continued use in preference to subtotal hysterectomy in women under the age of 36. Fundectomy is the operation of choice in cases requiring hysterotomy and sterilization. Beyond the age of 36 the uterus can be removed at the time of cesarean as a means of sterilization with good results.

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